

Linkage of Drinking Water Contaminant and Birth Outcome Data in New York State

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General Objective

- Link Public Water Supply Monitoring Data on Disinfection Byproducts (DBPs) with Birth Outcome Data to Track Patterns and Trends in Time and Space
- Study Population – NYS live births
 - 1998-2003

Why Link Birth Outcomes and Disinfection Byproducts (DBPs)

- Epidemiological studies have shown weak associations between DBPS (such as THMs) and adverse birth outcomes
 - Spontaneous fetal deaths
 - Low birth weight
 - Fetal growth restriction (IUGR, SGA)
 - Certain birth defects
- Short latency of birth outcomes
 - Limited exposure window

Birth Outcomes

- Low birth weight (<2500g)
- Preterm Birth (< 37 Weeks)
- Term Low Birth Weight (≥ 37 weeks; <2500g)
- Small for Gestational Age (lowest 10th percentile for age)
- Birth Defects
 - 22 Birth Defects identified by EPHT Workgroup

Birth Outcome Data

- Electronic birth certificate records – Vital Records
 - 250,000 per year
 - Geocoded to maternal address
 - ~94% Automatically geocoded
- 1998-2003 (~1.5 million births)
- Congenital Malformation Registry
 - Linked to birth certificate records

Birth Outcomes – Strengths / Weaknesses

➤ Birth Defects

- Strengths
 - Exposure may be more specific to certain birth defects
 - More limited exposure window
- Weaknesses
 - Small numbers for specific defects
 - Grouping defects not biologically or etiologically sound
 - Regional reporting issues

➤ Birth weight/Prematurity/SGA

- Strengths
 - More prevalent (larger numbers)
 - Numerator/Denominator from the same source (fewer reporting issues)
 - Well reported/Easily identified
- Weaknesses
 - Influence of SES, smoking, etc

Contaminants

➤ Total Trihalomethanes

- Chloroform
- Bromodichloromethane
- Dibromochloromethane
- Bromoform

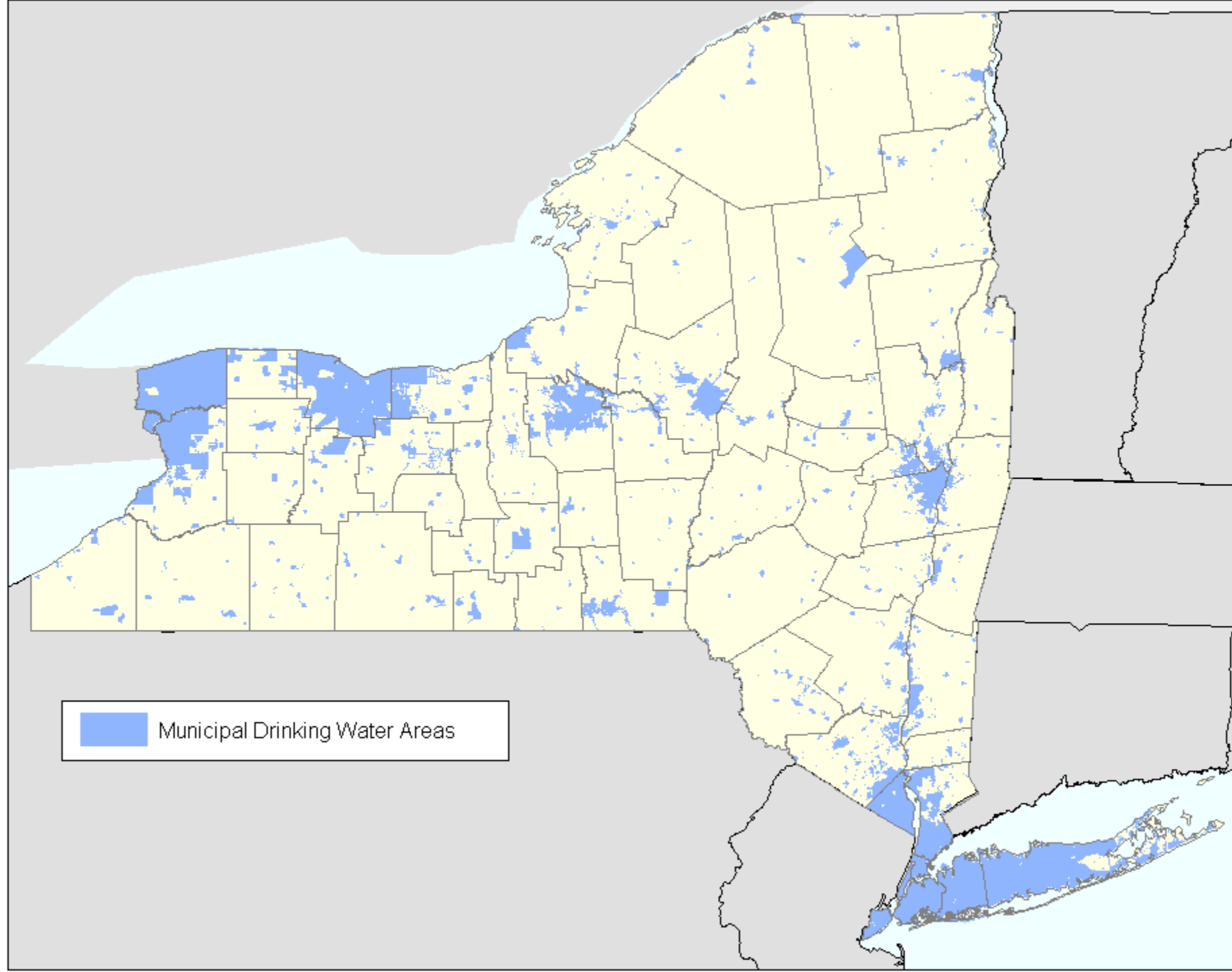
➤ Levels depend on source water characteristics such as level of organic matter, temperature as well as residence time

Environmental Database

- Safe Drinking Water Information System (SDWIS)/State
 - Monitoring results for total and individual THMs
 - Also contains information on HAAs, heavy metals, VOCs, pesticides, organics, nitrates, nitrites, radionuclides etc.
 - Mandated quarterly DBP monitoring for most systems
 - Some systems monitor more frequently
- Covers 90% of the State's population.
- Contains all sampling data – not just violations

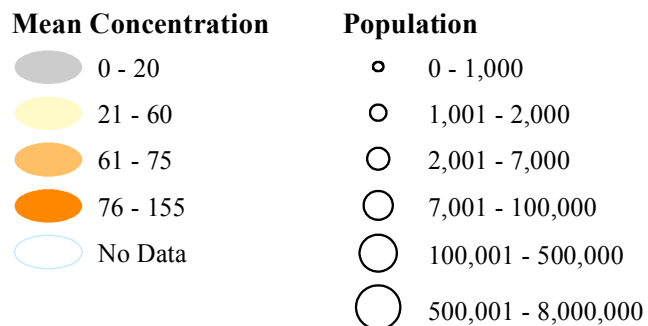
Water District Boundaries

- Developed a GIS layer of water supply system boundaries for systems serving >1,000 persons
 - County health departments – water system boundaries
 - GIS/CAD files from service providers
 - On-screen digitizing / scanned paper maps/drawings
 - Tax parcel centroid data
- Cover 95% of the State's population served by public water (>16,000,000 individuals)



 Municipal Drinking Water Areas

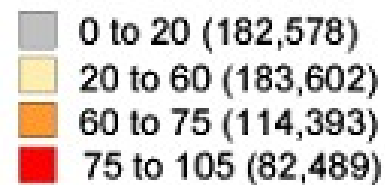
Total Trihalomethanes and Water Supply System Population



Data Linkage

- Geocode address at birth
 - Latitude/longitude estimated using automated geocoding system
- Assign each birth record to specific water district
 - Use GIS to make a “point in polygon” match
- Link DBP data from SDWIS based on the water district of birth

Average TTHM level , ug/L
(Population)



Saratoga

Schenectady

Rensselaer

Albany

0 7 14 Miles



Exposure Assessment

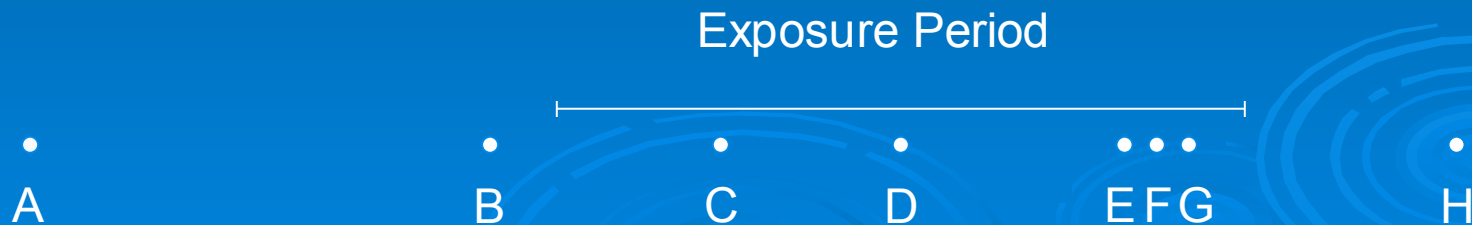
- Assume water district at birth is a proxy for THM “exposure” throughout pregnancy
- For each pregnancy we attempted to assign 4 estimates for each contaminant
 - Assigned THM measurements for each trimester & full pregnancy
 - For birth defects only the first trimester was evaluated
- THM samples not evenly spaced in time (e.g, two “quarterly” measurements may be taken in the same week – March 31 and April 1)

Exposure Metric

➤ Splines

➤ Weighted average

- All samples +/- 30 days of trimester used
- Multiple samples on the same day were averaged
- The weight given to a day is based on the proportion of the exposure period for which the day provides information about DBP levels.

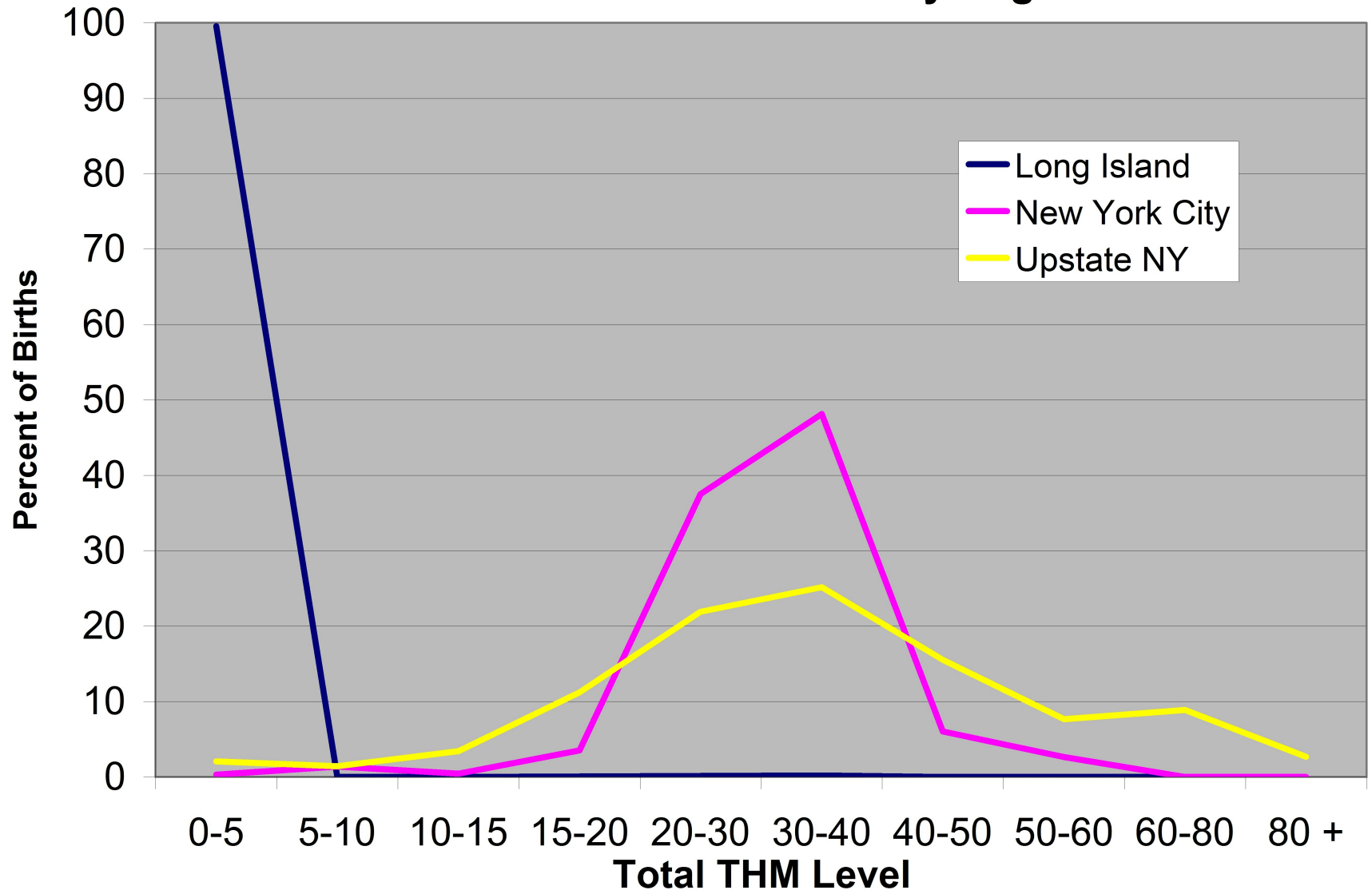


Exposure Assignment

Total THMs (2003 Births)

Births Usable	Births Unusable	
253,003	-	Total births
244,469 (97%)	(3%)	Invalid Date
212,733 (84%)	(13%)	Assign PWS
170,429 (67%)	(17%)	Full pregnancy
158,845 (63%)	(21%)	1 st trimester
160,113 (63%)	(21%)	2 nd trimester
160,778 (64%)	(21%)	3 rd trimester

Total THM Distribution in NYS by Region

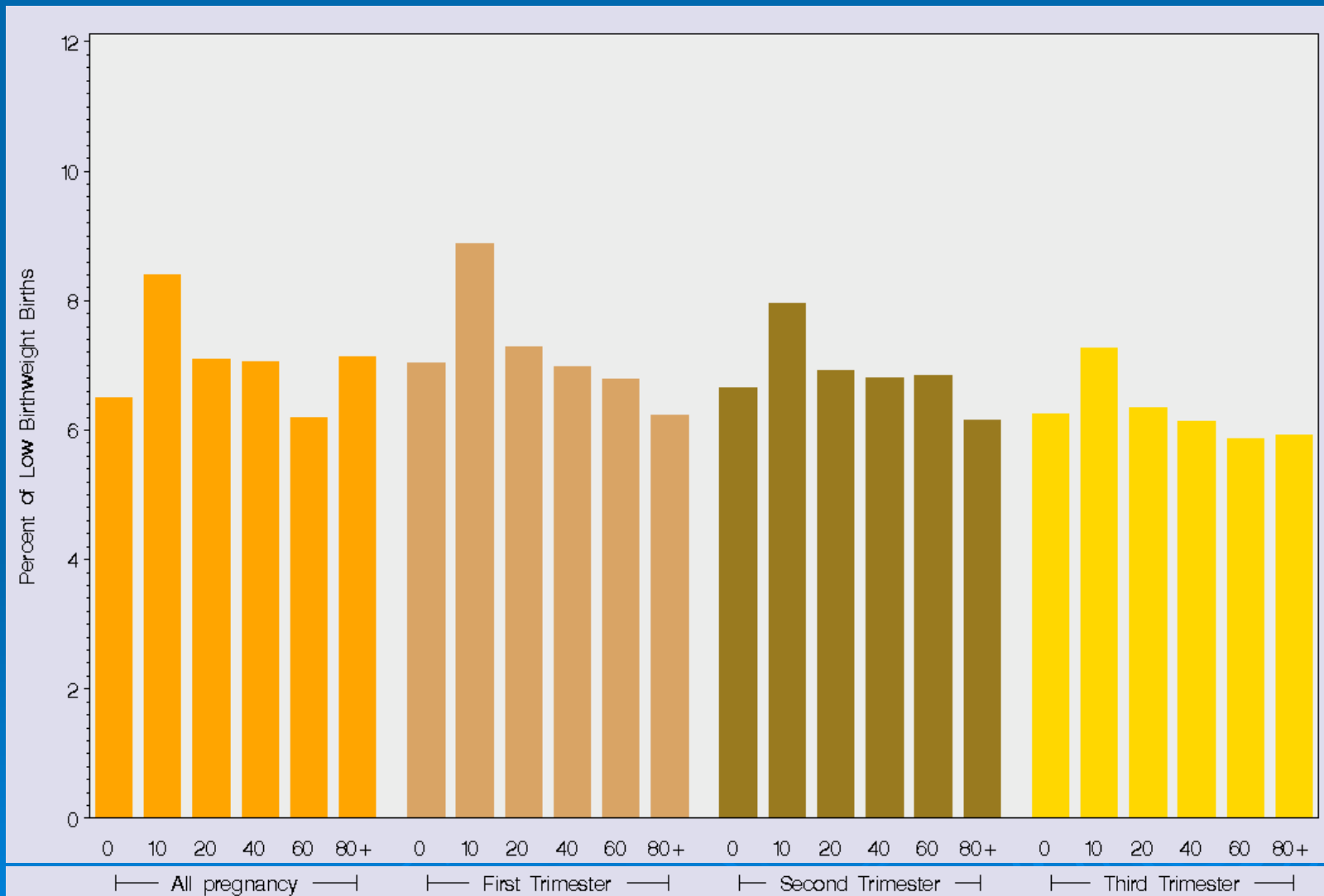


Analyses

- Exposure stratified prevalence rates of birth outcomes
- Logistic regression analysis
 - Controlled for:
 - mother's age, education, race, ethnicity, employment
 - gender, payor, and adequacy of prenatal care
- Analyzed birth weight as a continuous variable
 - Generalized Linear Model

Percent of Low Birthweight Births by Trimester

Upstate New York (including Long Island) 1998-2003

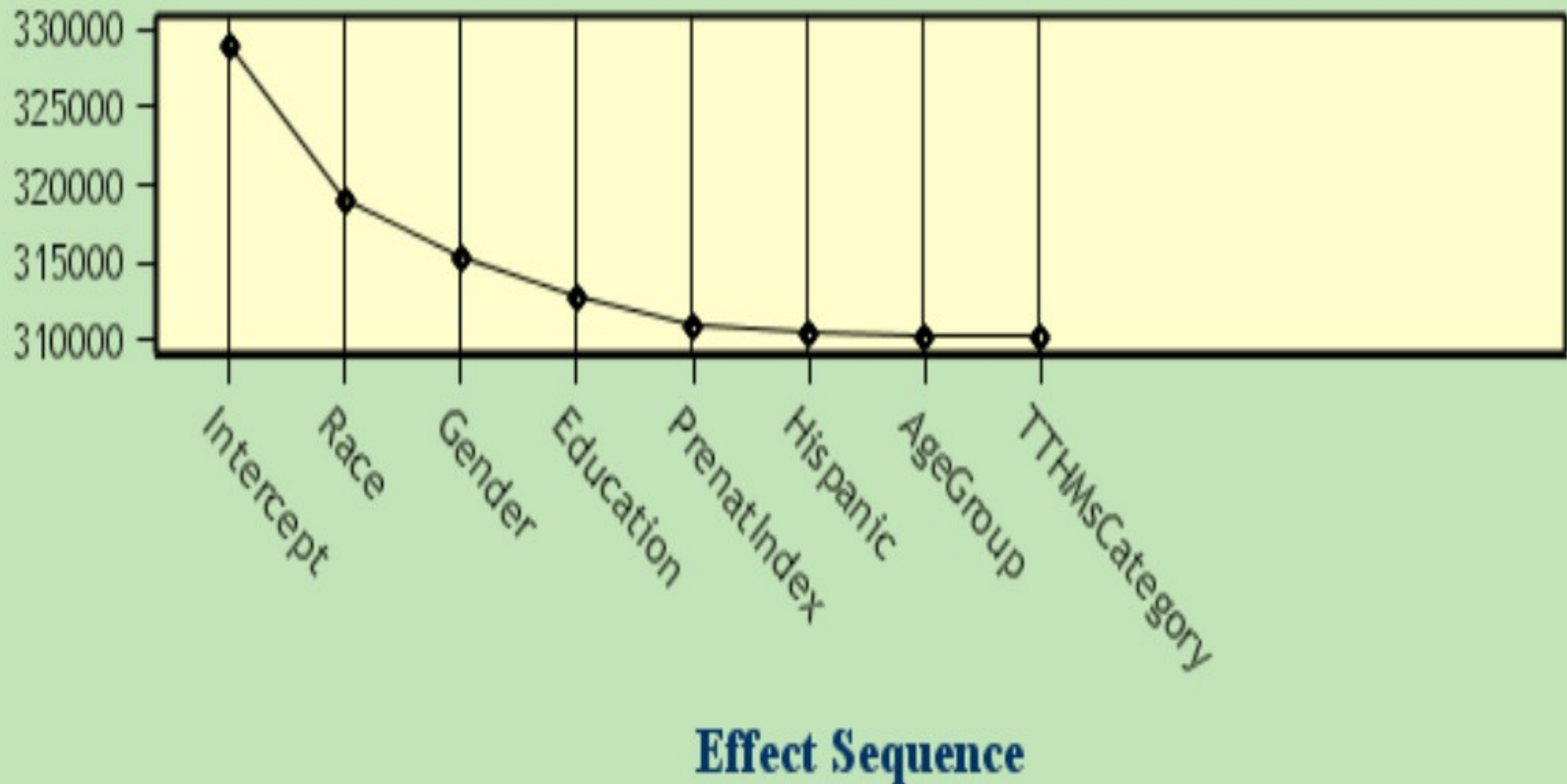


Total Trihalomethane Level

Low Birth Weight and TTHMs

TTHM (ug/L)	Long Island		New York City		Upstate	NY
	OR	95%CI	OR	95% CI	OR	95% CI
0-10 (reference)	-	-	-	-	-	-
10-15	0.0	(0.0-1000)	1.2	(1.0-1.4)	1.4	(1.2-1.6)
15-20	0.0	(0.0-1000)	1.1	(1.0-1.2)	1.1	(0.9-1.3)
20-25	0.0	(0.0-1000)	0.9	(0.8-0.9)	1.0	(0.9-1.2)
25-30	1.3	(0.2-10.2)	0.9	(0.8-0.9)	1.1	(0.9-1.3)
30-45	2.9	(0.9-10.1)	0.7	(0.7-0.8)	1.0	(0.8-1.1)
35-40	0.0	(0.0-1000)	1.0	(0.9-1.1)	1.0	(0.9-1.2)
40-60	0.0	(0.0-1000)	1.0	(0.9-1.1)	1.1	(0.9-1.2)
60-80	-	-	21.6	(9.9-47.0)	0.9	(0.8-1.0)
80 +	-	-	-	-	1.0	(0.9-1.3)

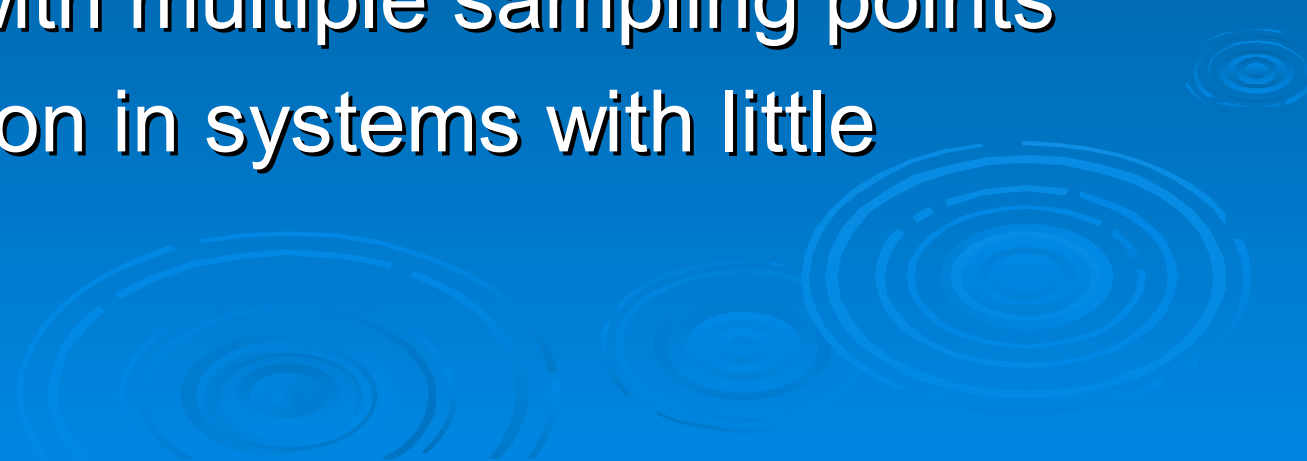
Validation Average Standard Error



Conclusions

- Odds Ratios close to 1 for most outcomes examined
 - LBW, Preterm, Term LBW, SGA
 - Individual THMs
- Little evidence of a dose response in any outcome-exposure combinations
- Surveillance system can be easily modified to examine other contaminants reported to SDWIS

Future Areas

- Incorporate HAA data into system
 - Incorporate additional contaminants as recommended by the CWG
 - Continue to analyze THMs
 - Subdivide large heterogeneous water systems with multiple sampling points
 - Interpolation in systems with little variability
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- The background of the slide is a solid blue color. In the lower right portion, there are several faint, concentric white circles that resemble ripples on water, creating a decorative effect.

The End

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Thanks

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